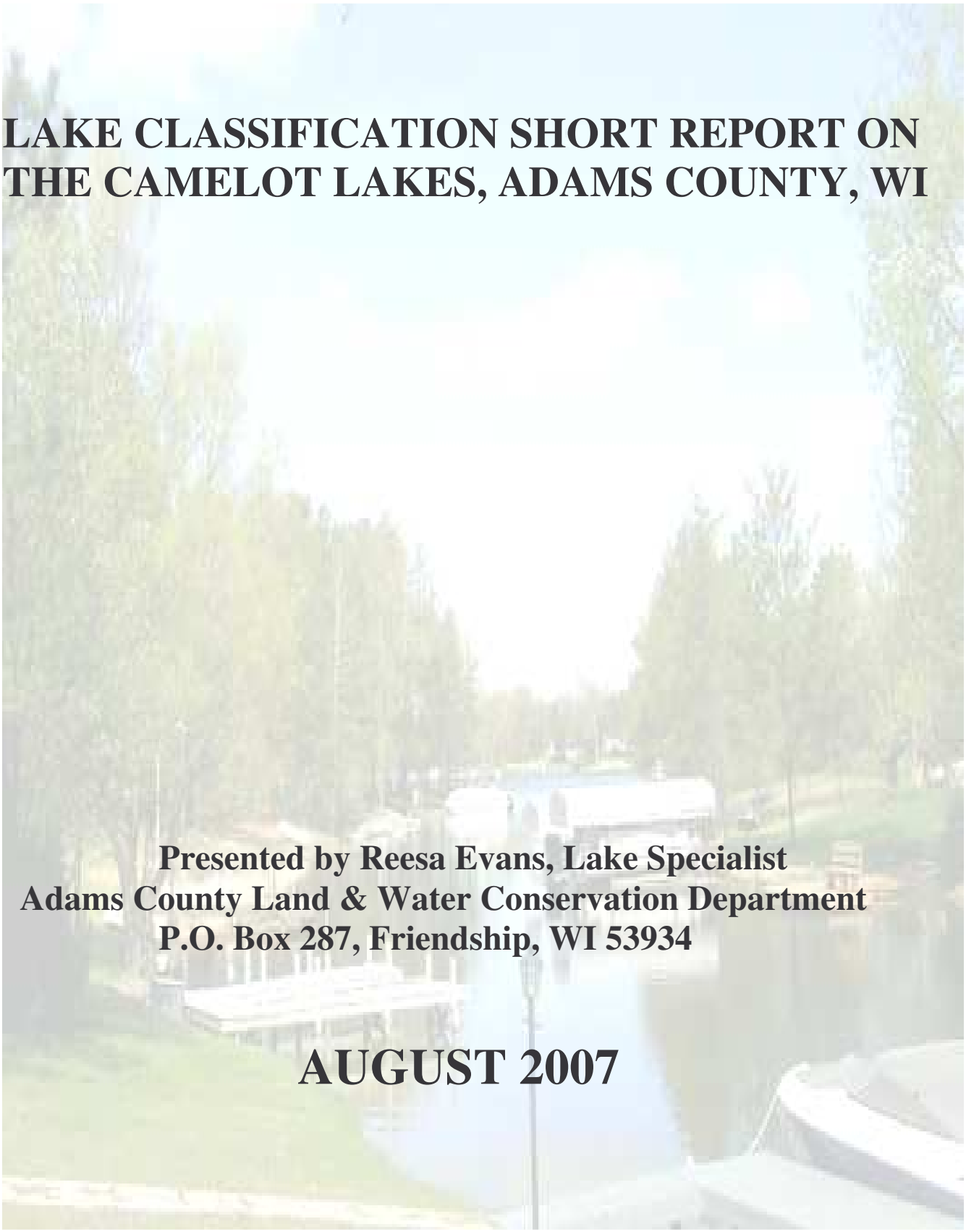
LAKE CLASSIFICATION SHORT REPORT ON THE CAMELOT LAKES, ADAMS COUNTY, WI



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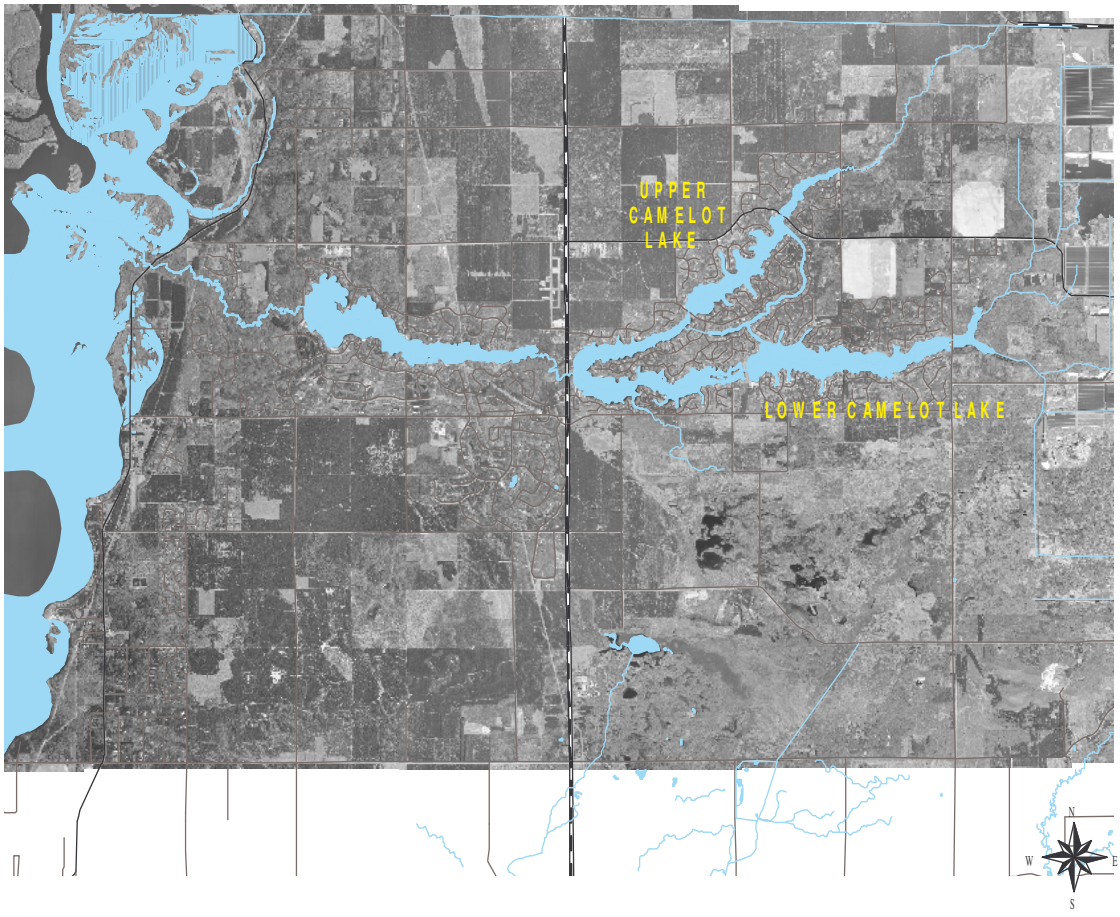
Introduction

Information about the Camelot Lakes: The Camelot Lakes are located in the Town of Rome, Adams County, WI (T20N, R6E), in the south central part of Wisconsin. They are part of a series of lakes commonly called "Tri-Lakes". Lower Camelot Lake is the first lake in the series, where Fourteen Mile Creek enters. Lower Camelot Lake is 260 surface acres, with a maximum depth is 24' and an average depth of 8'. Spring Branch Creek enters Upper Camelot Lake. Upper Camelot Lake has 191 surface acres, with a maximum depth of about 25' and an average depth of 8'. A channel connects Lower Camelot Lake to Upper Camelot Lake. There is a public boat ramp located on southwest side of Lower Camelot Lake owned by The Adams County Parks Department. The dams that impound these streams & form the lakes are owned and maintained by Adams County. The lake shores on both lakes are heavily developed.



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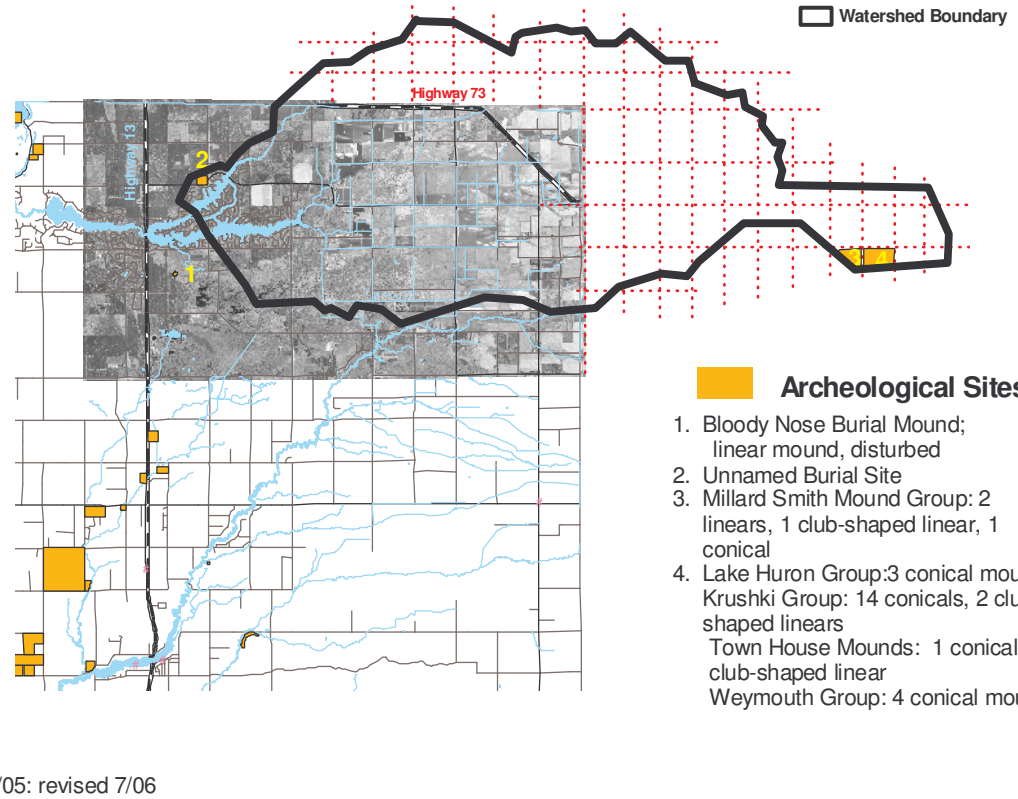
Archeological Sites
Camelot Lake Watersheds



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Conical mound

There are many Native American archeological sites in Adams County, with several being located right around in the Tri-Lakes watersheds. These mounds can be conical, linear or effigy (animal shapes) shapes. In order to preserve Native American heritage, federal and state laws on Native American burials require permission of the federal government and input from the local tribes before further disturbance.

Land Use

Both the surface and ground watersheds of the Camelot Lakes are very large, extending eastward into the next county. Studies have shown that lakes are products of their watersheds. Development around a lake's shore can have a great impact on the water quality of that lake, especially in the amount and content of stormwater runoff from the surface. Runoff volume is affected by the amount of impervious surface, the soil type and the slope of the area. Natural undisturbed landscapes tend to have low stormwater runoff rates.

Land use categories in acreage and percent of total are shown on the chart below:

	Surface		Ground		Total	
	Acres	% of Total	Acres	% of Total	Acres	% of Total
Agriculture--Non Irrigated	3250.09	27.16%	5348.05	13.78%	8598.14	16.93%
Agriculture--Irrigated	4016.26	33.56%	10,696.09	27.56%	14,712.35	28.97%
Government	0	0.00%	0	0.00%	0	0.00%
Grassland/Pasture	95.04	0.79%	3888.78	10.02%	3983.82	7.85%
Recreational	0	0.00%	0	0.00%	0	0.00%
Residential	1009.05	8.43%	1618.39	4.17%	2627.44	5.17%
Water	545	4.55%	58.9	0.15%	603.9	1.19%
Woodland	3052.97	25.51%	17,200	44.32%	20,253	39.89%
total	11,968.41	100.00%	38,810.21	100.00%	50,778.62	100.00%

Nearly 61% of the surface watershed for the Camelot Lakes is in agricultural use (both irrigated and non-irrigated). Agriculture may contribute significantly to the amount of nutrients in water.

Forested land is the second largest land use category in the Camelot Lakes surface and ground watersheds. Since forest floors are often full of leaves, needles and other duff, runoff from forested lands may be more filtered than that from agricultural or residential lands.

Residential land use is the third largest land use in both watersheds. Residential land use may also contribute a significant amount of nutrients to the water from stormwater runoff, mowed lawns, and impervious surfaces. Its contribution is likely to increase as development increases.

There are also wetlands in the Tri-Lakes area, especially east of the Camelot Lakes. Wetlands play an important role in water quality by trapping many pollutants in runoff waters and by serving as buffers to catch and control what would otherwise be uncontrolled water and pollutants. Wetlands also play an essential role in the aquatic food chain, thus affecting fishery, and also serve as spaces for wildlife habitat, wildlife reproduction & nesting, and wildlife food. It is essential to preserve these wetlands for the continued health of the Camelot Lakes waters.

Wetlands similar to those around Camelot Lakes

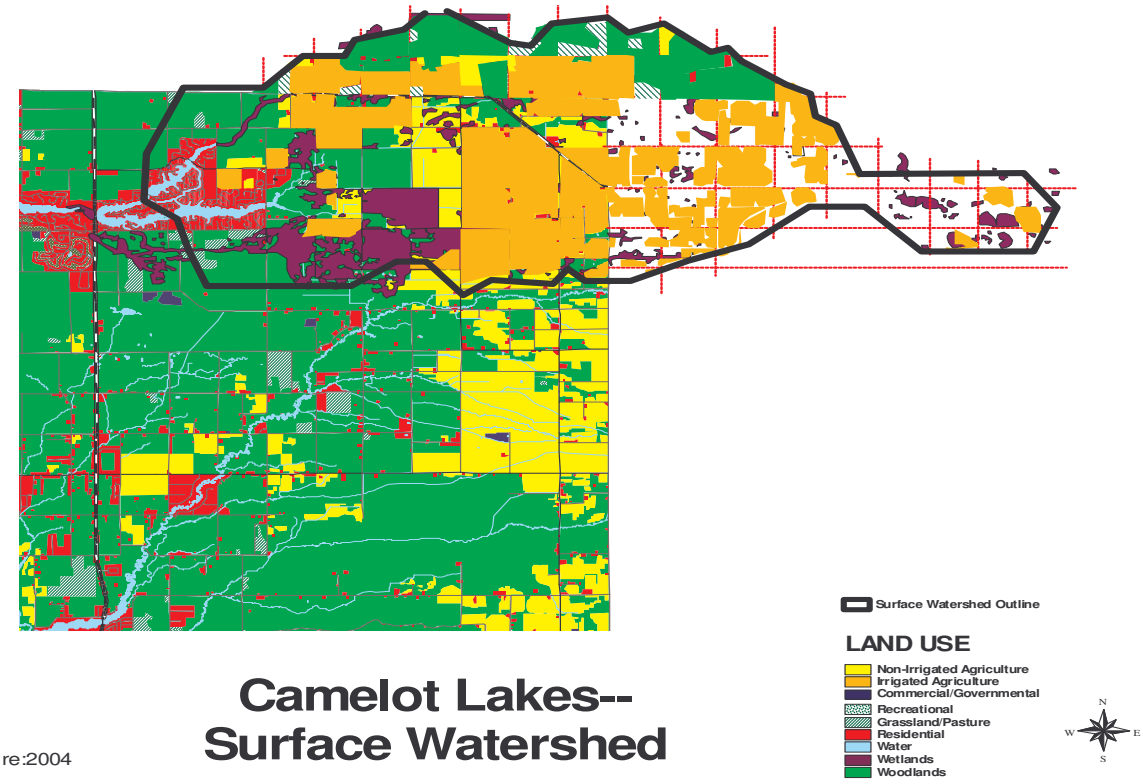
Lake many of the lakes in Wisconsin, the Camelot Lakes are phosphorus-limited lakes. This means that of the pollutants that end up in the lake, the one in the shortest supply and that most affects the overall quality of the lake water is phosphorus. Land use types play a major role in determining the amount of phosphorus being loaded into the lake. Recent statistics and computer modeling suggest that currently the ground watershed and agriculture are the greatest contributors of nutrients (including phosphorus) to the Camelot Lakes, although septic systems and residential use are also significant contributors.

Some aspects of phosphorus loading can't be modified by human behavior—they are simply part of the natural landscape. However, phosphorus loading from agricultural, residential and septic land use can be decreased or increased by changes in human activities.

The chart below shows differences increases or decreases could make just in the agricultural, residential and septic land use. The differences may not at first seem like a lot. But considering that one pound of phosphorus can produce up to 500 pounds of algae, simply reducing phosphorus output in these three categories by 10% could result in 1899 pounds **less** of phosphorus per year, which translates into as much as 949,500 pounds less per year of algae!

MOST LIKELY CURRENT PHOSPHORUS LOADING		
	% Total	lbs/yr
Irrigated Agriculture	30.0%	1789
Non-Irrigated Agriculture	19.4%	1157
Grassland/Pasture	0.2%	13
Residential	3.3%	180
Woodlands	2.3%	136
Other Water	0.2%	13
Groundwatershed	29.0%	1727
Lake Surface	1.0%	59
Septics	14.6%	871
total in pounds/year	100.0%	5947

MOST LIKELY CURRENT PHOSPHORUS LOADING				
	lbs/yr	-10%	-25%	-50%
Irrigated Agriculture	1789	282.6	1341.45	894.3
Non-Irrigated Agriculture	1157	1041.48	236.25	578.6
Grassland/Pasture	13	13	13	13
Residential	180	162.36	135.3	90.2
Woodlands	136	136	136	136
Other Water	13	13	13	13
Groundwatershed	1727	1554.3	1295.25	160
Lake Surface	59	59	59	59
Septics	871	784.08	653.4	435.6
total in pounds/year	5947	4046	3883	2380



Camelot Lakes--
Surface Watershed

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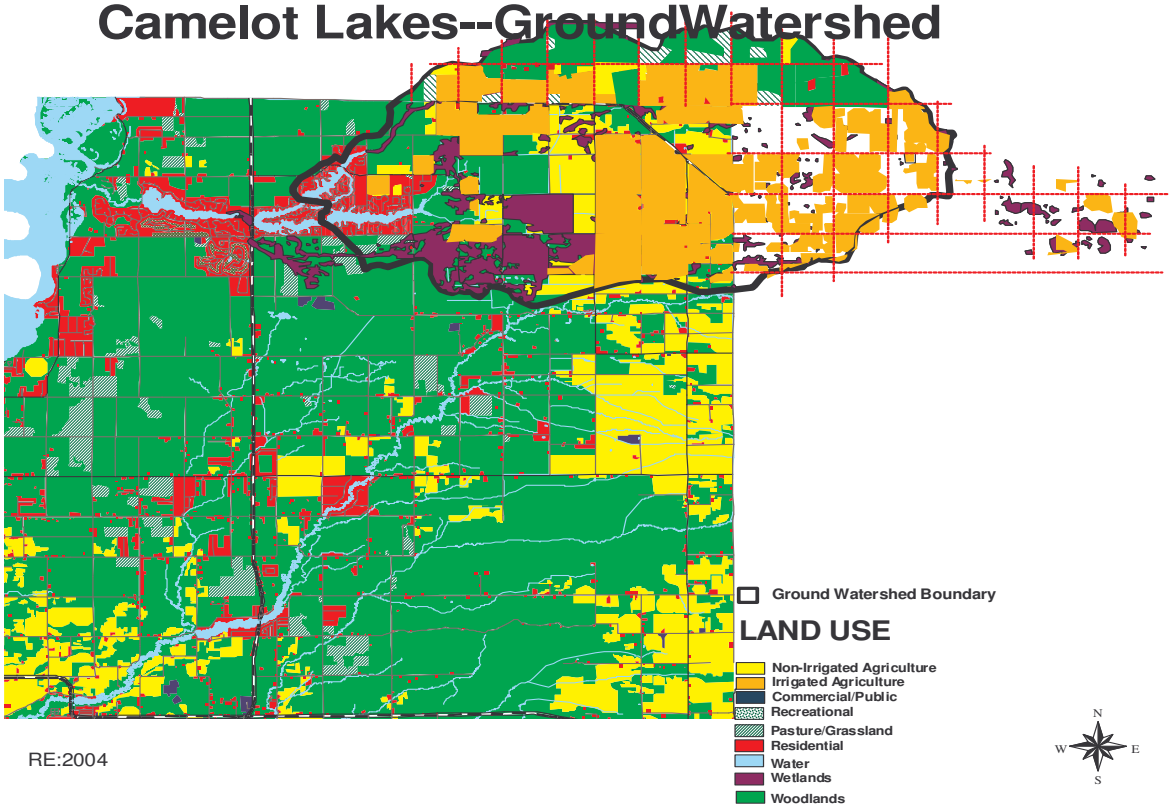
Camelot Lakes--GroundWatershed



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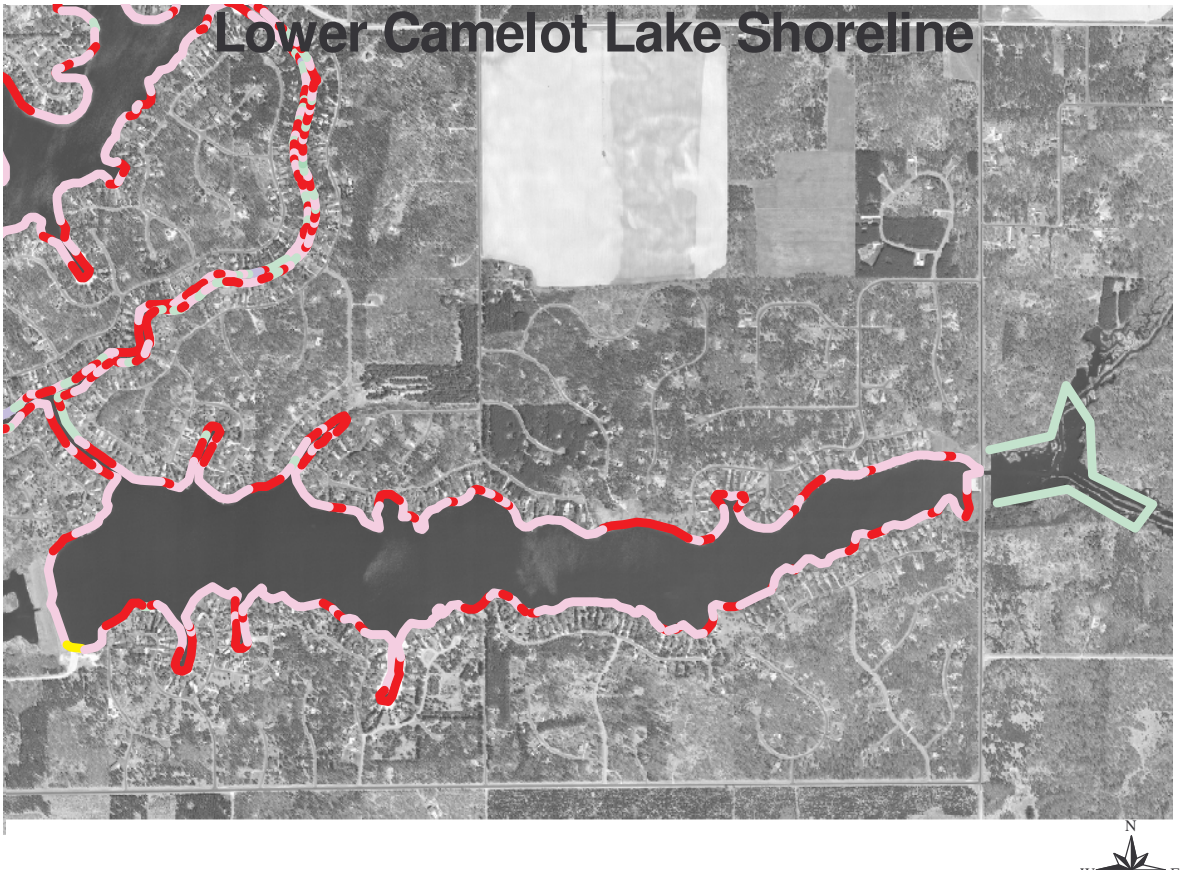
Shorelands

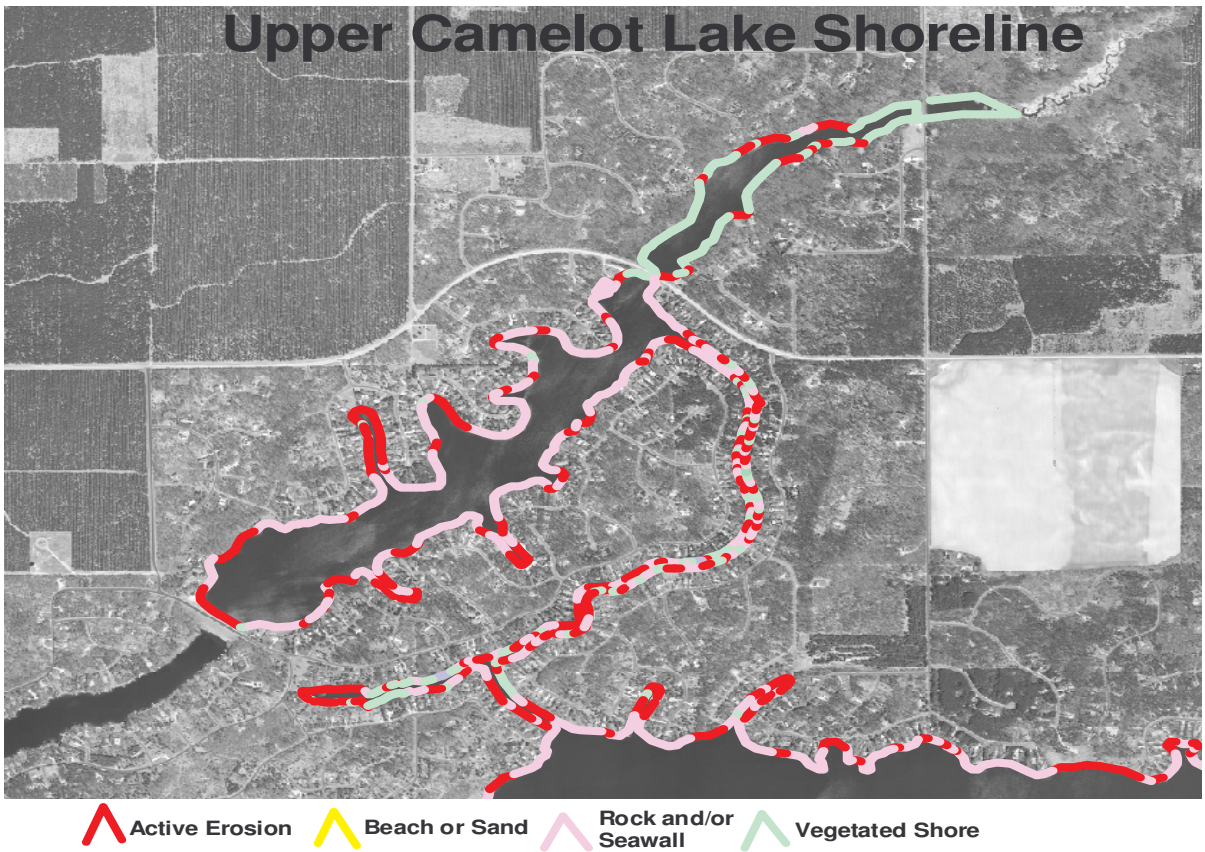
The Camelot Lakes have a total shoreline of 18 miles (95,040 feet). The bulk of the lakeshores are in residential use, with several beach clubs also located on the lakes. Some of the areas near the shores are steeply sloped, some are quite flat. Shores tend to be soft sand and subject to easy erosion.

Only about 25% of Upper Camelot Lake's shore has native vegetation at the water line; 63.5% of the shore is covered with traditional cultivated lawn, hard structure (piers, seawalls, etc.) and rock riprap. Lower Camelot Lake's shore has even less native cover (23%) and has 60% of the "developed" shore of lawn/hard structure/rock riprap. The lake shores also have from 11% to 15% sand or active erosion. The Camelot Channel has only 11% native vegetation at the shore, with 75.5% of the shore being "developed."

A 2004 shore survey showed that very few of the shores on these lakes and channel had an "adequate buffer." An "adequate buffer" is a native vegetation strip at least 35 feet landward from the shore.

Most of the "inadequate" buffer areas were those with significant hard structures (piers, patios, etc.), mowed lawns and/or insufficient native vegetation or at the shoreline to cover 35 feet landward from the water line.


Lower Camelot Lake Shoreline
N


Upper Camelot Lake Shoreline
Active Erosion
Beach or Sand
Rock and/or Seawall
Vegetated Shore
N
W
E
S

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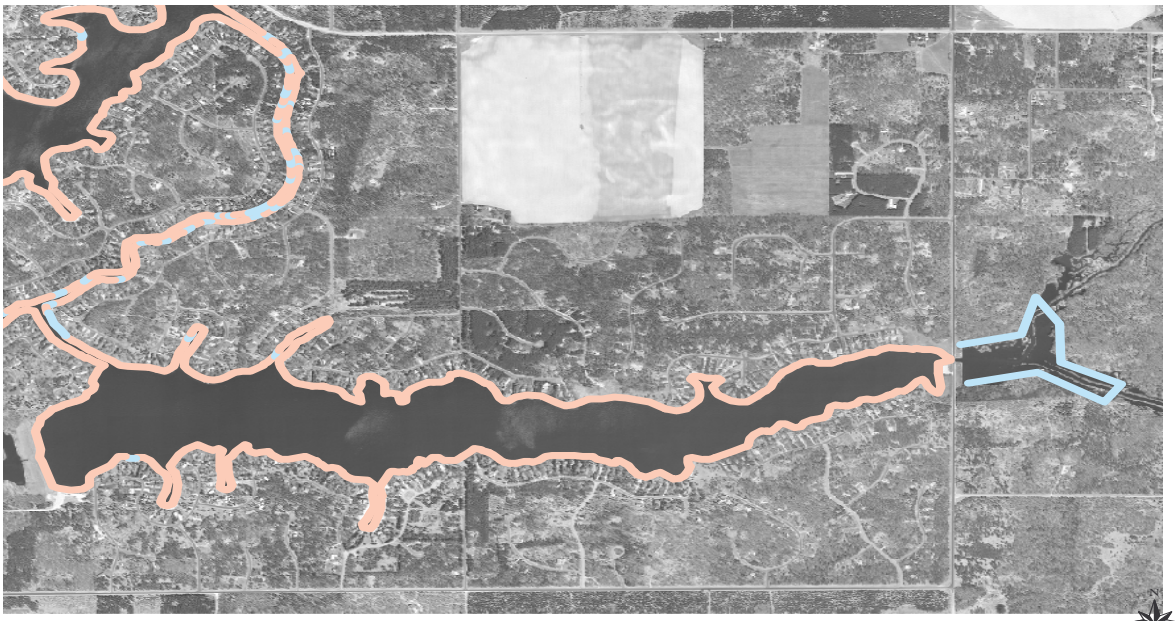
Buffers on Lower Camelot Lake



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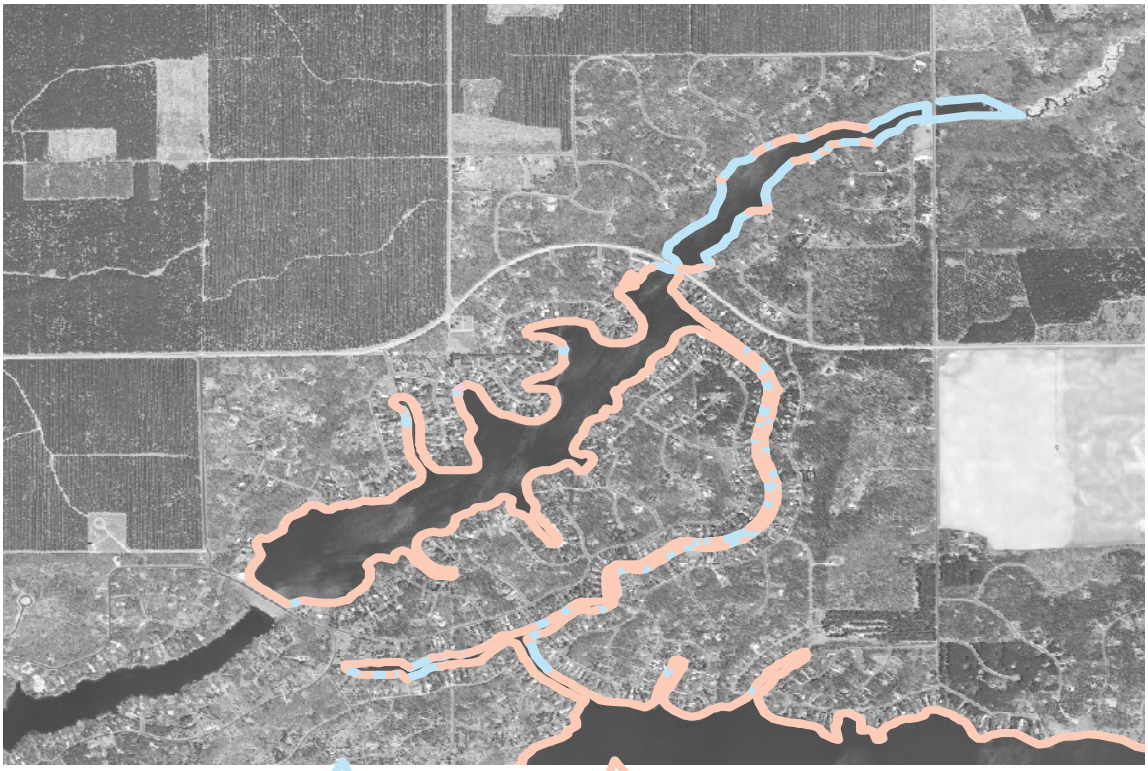
Adequate Buffer Inadequate Buffer

Buffers on Upper Camelot Lake



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Adequate Buffer Inadequate Buffer

Shoreland buffers are an important part of lake protection and restoration. These buffers are simply a wide border of native plants, grasses, shrubs and trees that filter and trap soil & similar sediments, fertilizer, grass clippings, stormwater runoff and other potential pollutants, keeping them out of the lake. A 1990 study by the Wisconsin Department of Natural Resources of Wisconsin shorelines revealed that a buffer of native vegetation traps 5 to 18 times more volume of potential pollutants than does a developed, traditional lawn or hard-armored shore. The filtering process and bank stabilization that buffers provide help improve a lake's water quality, including water clarity.

Example of Adequate Buffer

Example of Inadequate Buffer

Vegetated shoreland buffers help stabilize shoreline banks, thus reducing bank erosion. The plant roots give structure to the bank and also increase water infiltration and decrease runoff. A vegetated shore is especially important when shores are steep and soft, as are some of the Camelot shores.

Water Quality Information

One of the measures Wisconsin uses to give a general estimate of a lake's water quality is the **trophic state index.** This index looks at a lake's water clarity, its amount of total phosphorus (the element most related to aquatic plant and algal growth), and its chlorophyll-a level (chlorophyll-a is a pigment used by algae for photosynthesis).

Depending on the trophic index score, lakes are then classified as **Oligotrophic** (good)**, Mesotrophic** (fair)**,** or **Eutrophic** (poor)**.**

- **Good:** Oligotrophic lakes have clear, deep water with few algal blooms. Larger game fish are often found in such lakes.
- **Fair:** Mesotrophic lakes have more aquatic plant and algae production, with occasional algal blooms and a good fishery. The water is usually not as clear as that of oligotrophic lakes.
- **Poor:** Eutrophic lakes are very productive, with lots of aquatic plants and algae. Algal blooms are often frequent in these lakes. They may have a diverse fishery, but rough fish (such as carp) are also common. Water is often cloudy or murky. Small shallow lakes are more likely to be eutrophic.

Upper Camelot Lake's overall TSI is 50

Lower Camelot Lake's overall TSI is 53

Score	TSI Level Description
30-40	**Oligotrophic:** clear, deep water; possible oxygen depletion in lower depths; few aquatic plants or algal blooms; low in nutrients; large game fish usual fishery
40-50	**Mesotrophic:** moderately clear water; mixed fishery, esp. panfish; moderate aquatic plant growth and occasional algal blooms; may have low oxygen levels near bottom in summer
50-60	**Mildly Eutrophic:** decreased water clarity; anoxic near bottom; may have heavy algal bloom and plant growth; high in nutrients; shallow eutrophic lakes may have winterkill of fish; rough fish common
60-70	**Eutrophic:** dominated by blue-green algae; algae scums common; prolific aquatic plant growth; high nutrient levels; rough fish common; susceptible to oxygen depletion and winter fishkill
70-80	**Hypereutrophic:** heavy algal blooms through most of summer; dense aquatic plant growth; poor water clarity; high nutrient levels

Water clarity readings are usually taken by using a Secchi disk (shown at right). **Average summer Secchi disk clarity in Lower Camelot Lake in 2004-2006 was 5.54' feet**. This places it in the "fair" category for water clarity. **Average summer Secchi disk clarity in Upper Camelot Lake in 2004-2006 was 6.19'.** This puts it in the "good" category for water clarity.

Records since 1985 show similar ranges for water clarity for Lower Camelot: between 1986-1990, clarity averaged 5.7'; between 1991-1995, average was 5.6'. However, clarity for Upper Camelot was higher in the past: 1986-1990 average for Upper Camelot was 7.5'; between 1991-1995, it was 12'. Water clarity can be reduced by turbidity (suspended materials such as algae and silt) and dissolved organic chemicals that color or cloud the water. These sometimes occur due to increased shore development or greater boat traffic.

Increased phosphorus levels in a lake will feed algal blooms and also may cause excess plant growth. **The 2004-2006 summer average phosphorus concentration in Lower Camelot Lake was 23.17 micrograms/liter. The average for Upper Camelot Lake was 16.92 micrograms/liter.** Both of these levels score "good" in the total phosphorus category and are below the average 30 micrograms/liter for impoundments in Wisconsin.

From 1991-1995, average total phosphorus for Lower Camelot was 24.5 micrograms/liter; for Upper Camelot, it was 15 micrograms/liter. Phosphorus should always be monitored, since it is the element that most contributes to dense aquatic plant growth and algal blooms.

The third measure used in trophic state classification is the amount of chlorophyll-a contained in the lake. The amount of chlorophyll-a found in a lake is an indication about the amount of algae in the lake. **The 2004-2006 summer average chlorophyll-a concentration in Lower Camelot Lake was 15.53 micrograms/liter.** This level of chlorophyll-a gives Lower Camelot Lake a "fair/poor" ranking for chlorophyll-a, suggesting frequent algal blooms are probably occurring. Average for the 1990s was 19 micrograms/liter—slightly lower and squarely in the "poor" category.

The summer average chlorophyll-a concentration in Upper Camelot Lake was 11.9 micrograms/liter. This places Upper Camelot Lake in the "fair" category. It probably has fewer algal blooms than Lower Camelot Lake, but chlorophyll-a readings are high enough that some blooms would be expected. Average in the 1990s was 8.5 micrograms/liter, in the "good" category.

In-Lake Habitat

Aquatic Plants

A diverse aquatic plant community plays a vital role in improving water quality, providing valuable habitat resources for fish and wildlife, resisting invasions of non-native species and checking excessive growth of the most tolerant species.

Updated aquatic plant surveys were performed in 2006 was performed on both lakes and the Camelot Channel. In general, these surveys showed that the aquatic plant communities had changed since the last surveys in 2001. The biggest change was that more plants tolerant of disturbance were found or that plants tolerant of disturbance were found in more density.

In Lower Camelot Lake, the 1.5'-5'depth zone supported the most abundant aquatic plant growth. *Chara* spp (muskgrass, a plant-like algae), *Elodea canadensis* (waterweed), *Myriophyllum* spicatum (Eurasian watermilfoil, an invasive exotic), *Najas flexilis* (bushy pondweed), and *Vallisneria americana* (water celery) were the most common aquatic species. Four species had higher than average density of occurrence where they were present.

More detailed information can be found in the aquatic plants report of the 2006 surveys, available on request from the WDNR or Adams County Land & Water Conservation Department.

Curly-Leaf Pondweed

Reed Canary Grass & Purple Loosestrife

Eurasian Watermilfoil

Some of the most common aquatic vegetation in the Camelot Lakes.

***Chara* spp**

Najas flexilis

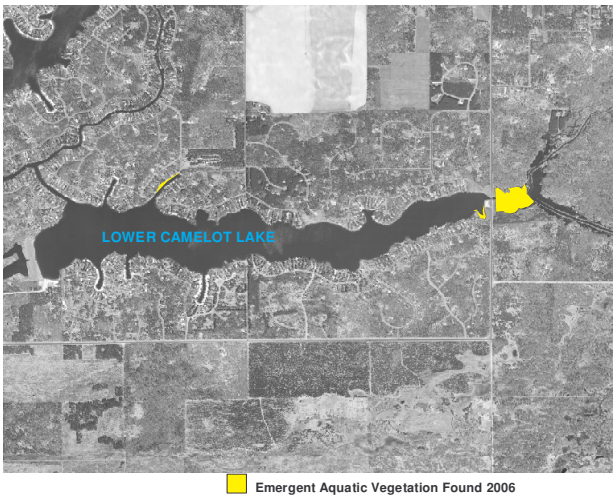
Vallisneria americana

The Camelot Channel was surveyed separately in 2006. In the channel, the 0-1.5' depth zone had the highest occurrence of aquatic plant growth. The most-frequently occurring plants in the channel were *Myriophyllum spicatum* and *Najas flexilis.* *Potamogeton crispus* (curly-leaf pondweed), an exotic invasive, was also found in the channel, but was not frequently-occurring. Six species had higher than average density where present.

In Upper Camelot Lake, the 5'-10' depth zone had the highest occurrence of aquatic plant growth, although the 0-1.5' depth zone was close behind. The most frequently occurring species in this lake were *Certaphyllum demersum* (coontail) and *Najas flexilis.* Both *Myriophyllum spicatum* and *Potamogeton crispus* were found, but not in high frequency of occurrence or high density. However, 8 plants were found in more than average density where present.

Important to maintaining a quality, diverse aquatic plant community is an integrated aquatic plant management plant that controls the invasive plants in the lake.

Emergent Vegetation in Lower Camelot Lake 2006



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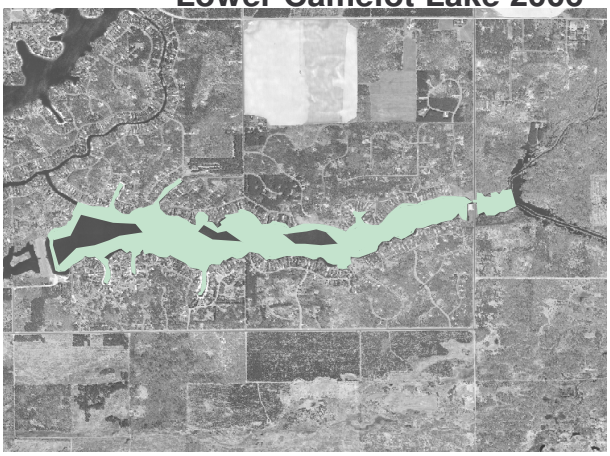
Emergent Aquatic Vegetation Found 2006

Submerged Vegetation Found in Lower Camelot Lake 2006



Submerged Vegetati
Found in 2006

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Exotic Aquatic Vegetation Found in Lower Camelot Lake 2006

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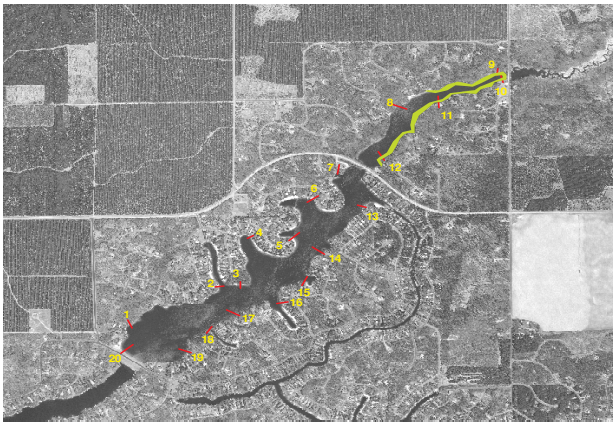
Exotic Aquatic Vegetation
Found in 2006

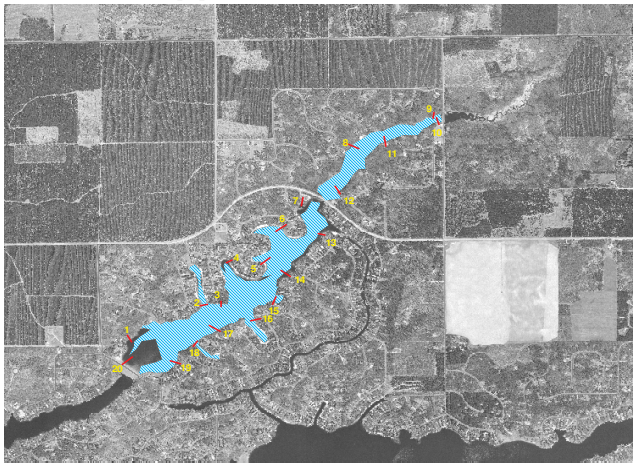
Emergent Vegetation in Upper Camelot Lake 2006



Emergent Vegetation Found in Lake 2006

RE:11/06

Submerged Vegetation in Upper Camelot Lake 2006



Submerged Aquatic Vegetation Found 2006

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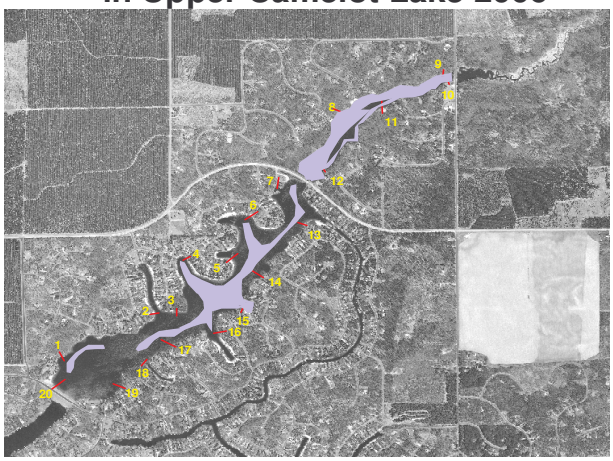
Exotic Aquatic Vegetation Found in Upper Camelot Lake 2006



RE:11/06

Exotic Aquatic Vegetation Found 2006

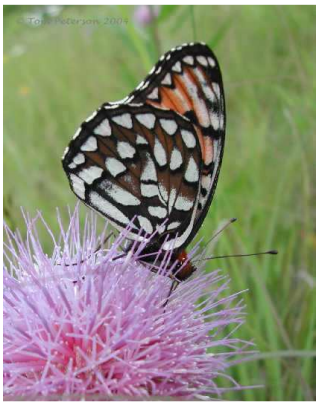
Fishery/Wildlife/Endangered Resources

The most recent fishing inventory of the Camelot Lakes, in 2002, showed that bluegills, largemouth bass and yellow perch were abundant. Crappies, northern pike and walleyes were present, but scarce. In the past, bullheads, golden shiners, pumpkinseeds and white suckers have also been found in the lake, as have carp. There was a chemical kill of fish on the Tri-Lakes in 1967 to deal with carp. There is also a history of fish kills from the *Columnaria* bacteria (a native bacteria). WDNR stocking records indicate stocking of bluegills, largemouth bass, northern pike and walleye in the past.

Muskrats have been seen on these lakes. Seen during the field survey were various types of waterfowl and songbirds. Frogs and salamanders are known, using the lake shores for shelter/cover, nesting and feeding. Turtles and snakes also use this area for cover or shelter in this area, as well as nested and fed in this area. Upland wildlife feed and nest here as well.

There are endangered resources known to be in the Camelot watersheds. The long-leaved aster (*Aster longifolius*) is the only special plant reported there, but there are three butterflies, a leafhopper and a bird also known to be there. The butterflies are the Gray Copper butterfly (*Lycaena dione*), the Karner Blue Butterfly (*Lycaedides melissa samuelis*), and the Regal Fritillary butterfly (*Speyenia idalia*). The Greater Prairie Chicken (*Tympanuchus cupido*) has booming grounds in the eastern part of the watersheds. A leafhopper (*Graphocephala* spp) has also been reported in these watersheds.

Gray Copper



Regal Fritillary

Greater Prairie Chicken

Recommendations

Lake Management Plan

- A Total Maximum Daily Load calculation needs to be incorporated and implemented as part of the lake management plan. This will permit a nutrient budget to be developed.
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Watershed Recommendations

- Since computer modeling results suggest that input of nutrients, especially phosphorus, are a factor that needs to be explored for these Lakes, it is recommended that both the surface and ground watersheds be inventoried, documenting any of the following: runoff from any livestock operations that may be entering the surface water; soil erosion sites; agricultural producers not complying with nutrient management plans and/or irrigation water management plans.
- If such sites are documented, the Tri-Lakes Management District and the Camelot Property Owners Association should encourage landowners to work with the Adams County Land & Water Conservation Department to design and implement practices to address site issues.

Water Quality Recommendations

- All lake residents should practice best management on their lake properties, including keeping septic systems maintained in proper condition and pumped every three years, eliminating the use of lawn fertilizers, cleaning up pet wastes and not composting near the water.
- Reducing the amount of impervious surface around the lake and management of stormwater runoff will also help maintain water quality.
- Residents should become involved in the Citizen Lake Water Monitoring Program. This includes water quality monitoring, invasive species monitoring and Clean Boats, Clean Waters.
- Lake residents should protect and restore natural shoreline around the Camelot Lakes and channel. Massive shore restoration would probably improve the water quality of the lake. The current high development of the lake shore is not likely to improve water quality. Studies have shown that shore disturbance is likely to negatively impact the aquatic plant community and water quality of a lake.

Aquatic Plant Recommendations

- All lake users should protect the aquatic plant community in the Tri-Lakes by assisting in implementing and reviewing an integrated aquatic plant management plan that uses multiple methods of aquatic plant control.
- The Camelot Lake Property Owners Association and the Tri-Lakes Management District should maintain exotic species signs at the boat landings and contact DNR if the signs are missing or damaged.
- The Tri-Lakes Management District should continue monitoring and control of Eurasian Watermilfoil maintain the most effective methods and modify if necessary. The Lake Association should investigate ways to increase treatment effectiveness in the deeper water. Residents may need to hand-pull scattered plants.
- Lake residents should get involved in the county-sponsored Citizen Aquatic Invasive Species Monitoring Program. This will allow not only noting changes in the Eurasian Watermilfoil pattern, but also those for Curly-Leaf Pondweed and other invasives. Noting the presence and density of these species early is the best way to take preventive action to keep them from becoming a bigger problem.